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Kahuku Community Association

DEPT OF PLANNING
AND PERMITTING
CITY & COUNTY OF HONOLULU

April 6th, 2021

To whom it may concern:

Kahuku Community Association (KCA) is writing in strong support of Resolution 19-305 which proposes to amend the Land Use Ordinance to require wind turbines 100KW or greater to have a 5 mile set back from all property lines. We would also strongly urge the rejection of the DPP's recommended Bill A which would amend this setback to 1500 ft or 2 feet for each foot from the highest vertical extension whichever is greater from all property lines.

KCA understands the need for clean energy as our communities are seeing, and currently experiencing, the devastating effects of extreme weather events from climate change. However, we also firmly believe that renewable energy projects must be done responsibly and not at the cost of the health, safety, and quality of life of host communities and its residents. When projects are poorly developed and managed, the impacts of these projects can be so great that they outweigh any benefit the project may provide.

The latest Na Pua Makani wind project is a prime example. Over 200+ community members were arrested protesting its construction. One of the main reasons the community was so upset was the poor siting done by the developer. Three of the 568 foot turbines being sited are less than 1,700 feet away from homes and schools. Existing farm dwellings are less than 700 ft away from these industrial scale wind turbines because the current set back regulations exclude homes of farmers on agricultural land. There has never been a residential zoned community placed in such close proximity to industrial scale wind turbines as Kahuku. DPP's recommendation of 1500 feet is still severely inadequate and completely undermines the community's concerns. In addition, it has recently come to light that the City and County of Honolulu likely violated the law when approving a waiver for minimum setbacks placing them as close as 284 feet to property lines. These facts are very concerning to our community. It is clear that more regulation relating to the siting of wind turbines is needed.

In addition, there are legitimate concerns regarding the detrimental health risks these turbines impose on our children and residents of our community. Kahuku the Na Pua Makani turbines are very close to Kahuku Elementary and High Schools, and residences. This is particularly worrisome to many parents who wonder about the long term effects the exposure to infrasound, pulsating sounds and shadow flicker could have on their children. Hanning noted in 2010 that, "Of particular concern were the observed effects on children, including toddlers and school and college aged children. Changes in sleep pattern, behaviour and academic performance were noted. 7 of 10 children had a decline in their school performance while exposed to wind turbine noise which recovered after exposure ceased" (22)." If the life of industrial turbines range from 20 - 30 years, this would mean that Kahuku children will have lived a majority of their developmental life period being exposed to the effects of these turbines.

The wind industry claims that the science on health effects related to industrial wind turbines is conclusive, but this is incorrect. Many studies and organizations, such as U.S.G.S. (2011), Ambrose, Rand and Krogh (2012), Nissenbaum, Aramini, and Hanning (2012), Barry, Sulsky, Kreiger (2018), Council of Canadian Academies (2015) and Alves-Pereira, Rapley, Bakker and Summers (2019) state that there is a need for more studies done on the link between industrial wind turbines and negative health effects possibly resulting from exposure to noise, infrasound, or shadow flicker. The World Health Organization Noise Guidelines for the European Region (2018) states that, "[m]ethodologically robust longitudinal studies with large samples investigating the quantitative relationship between noise from wind turbines and health effects are needed."



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Furthermore, many reports and studies, such as Ambrose, Rand and Krogh (2012), Bolin, Bluhm, Eriksson and Nilsson (2011), Nissenbaum, Aramini, and Hanning (2012), Jefferey (2013), Salt and Lichtenhan (2014), Salt and Hullar (2010), Alves-Pereira and Branco (2007), Phillips (2011), and Laurie (2015), conclude that there are adverse health effects stemming from noise, infrasound, or shadow flicker from wind turbines. It would be irresponsible and negligible to continue to allow residents of this state to act as guinea pigs against their will and possibly suffer health effects such as tinnitus, headaches, migraines, loss of sleep, increase epileptic seizures, nausea, dizziness and inability to focus for prolonged periods of their lives.

Wind turbines create both audible and inaudible noise. The audible noise emitted from wind turbines rotating blades are repetitive which is a source of greater annoyance and separates them from other environmental noises. (Schäffer et al., 2016) "The burden of environmental noise with wind turbines is not episodic or random: for the most part its effects are constant and unrelenting, nothing like an occasional aircraft over the house, nor the 70 plus dB experienced at a concert for a few hours. This is an undeniable health pressure of enormous magnitude." Long term exposure to noise is a stressor that causes adverse health effects. This leads to auditory injuries such as hearing loss and tinnitus. Non auditory effects on health are psychological and physiological distress.

Furthermore, there are safety risks, such as blade throw and tower collapse (as was experienced by the Auwai turbines on Maui in 2016), stray voltage, and toxic fires that cannot be extinguished (as was experienced by the Kahuku community in 2012) that must be understood and properly mitigated to secure health and safety of our residents. The City of Lincoln Nebraska noted, "Because of widespread concerns about health and safety, many jurisdictions scattered around the United States and Canada have adopted larger setbacks in recent years" (lincoln.ne.gov, 2015).

Even as wind turbine companies deny these findings and tout their own corporate funded and biased studies, the concept of international law and trade and environmental agreement is the Precautionary Principle which states that if scientific evidence is inconclusive it is always best to err on the side of protecting human health. Our children and families deserve this consideration.

Increasing the setback from residential homes, schools, medical facilities and farm dwellings is imperative to protect community members from harm and possible adverse health effects from industrial scale wind turbines. The only proven safety measure is to have a safe and adequate set back distance. Given that there is no current regulation and protection against infrasound, a greater set back distance is needed and we strongly believe that Resolution 19-305 that recommends a 5 mile is the step in the right direction.

Respectfully,

Jessica dos Santos

Kahuku Community Association Board of Directors,

Jessica dos Santos - President

Maria Tejada - Vice President

Sunny Unga - Secretary

Melissa Ka'onohi-Camit - Director

Atalina Pasi - Director

***See attachment: INDUSTRIAL WIND TURBINES - Annotated Bibliography & Research Summaries

ATTACHMENT

Industrial Wind Turbines – Annotated
Bibliography & Research Summaries

INDUSTRIAL WIND TURBINES - Annotated Bibliography & Research Summaries

*** A shared version of this document with clickable links can be accessed here:

https://docs.google.com/document/d/11NhD_1Ixr1If3Azbi_FEUnHNV_qoeINShBe7Fo3U5UE/edit?usp=sharing

Additional (unsorted) Resources:

Detail	Source
Zou (2017) Wind turbines increased suicide rates during windy periods in residents more than 25 km upwind and downwind of turbines. University of Illinois researchers studied 828 turbine installation events spanning 39 states in the United States from 2001 to 2013. Sleep disturbance is the likely cause.	http://en.friends-against-wind.org/doc/turbine_zou201710.pdf?fbclid=IwAR0GqXPeFzGXCKr5jDkwoaDh2LGHGFSplwLvQxzv_AMcIKavKV747mFaqBU
Cape Bridgewater (2014-2015) Residents reported severe impacts (significant changes in behavior, and/or inability to mitigate effect leading to psychological stress or physiological effects, e.g., regular sleep deprivation/awakening, loss of appetite, significant, medically definable harm at 1 Hz, 58 - 72 decibels	https://drive.google.com/drive/folders/1x2bYkbITkTN_vmeht3eh8Row3tLpmkoQ?usp=sharing
Dr Alves Pereira (2019) University of Waterloo presentation (wind turbine low-frequency sound pressure is chronic – though exposure levels are usually below level of occupational exposure of military aircraft workers, biological effects to tissues are expected to be similar – thickening of the pericardial tissues around the heart, changes in collagen related to thickening of arteries, increased epilepsy, high blood pressure, heart conditions. In addition, low-frequency sound (55-60 dB at 1 Hz) caused residential structures to resonate (55-60 dB at around 10 Hz) – the resonance frequency of wood frame and concrete structural materials is around 10 Hz – in addition to low-frequency sound itself, the structure's resonance is often the significant cause of discomfort, causing the people to move away or sleep in the basement)	https://livestream.com/itmsstudio/events/8781285/videos/196181579?fbclid=IwAR3pwiRLGzoHYKJqmEZJhuIjCHebJIrgaPlQauPpGpDntVONYuf6oHygLo
Stepanov (2000) Biological effects of low frequency oscillations (Russian 75 dB limit for 2 Hz. low-frequency sound for "living and public premises" based on exposure time, p. 15.	https://apps.dtic.mil/dtic/tr/fulltext/u2/a423963.pdf
Walker, Hessler, Rand, and Schomer (2012) Shirley Wind Farm, Wisconsin, in particular Appendix C, Rand Acoustics, pp 35-36, intolerable to be in their homes (headaches, nausea, sleep interference, misery) when wind turbines on (intolerable at 73 decibels at 0.3 Hz fundamental frequency, relief at 3.5 miles away (61 dB at 0.3 Hz).	
Salt and Hullar 2010 low frequency sounds turbines	
Schaffer 2016 Wind turbine more annoying than road noise same dB Punch and James 2016 – review of literature	

Pierpont (2009) Wind Turbine Syndrome book by physician, see "Report for Clinicians, Table 3 (Page 51) and Chapter 3, Case Histories, the raw data indicating affected residents are not otherwise sick compared to the general population, indicating sleep disturbance affects 89% of residents who are affected by wind turbines.

Noise

Detail	Source
Synthesis of research of multiple noise/sleep studies done in Europe and U.S. including setback recommendations	http://puc.sd.gov/commission/dockets/Civil/2018/civ18-70/batenumbr/Internet/3187-3721.pdf
	https://www.windwahn.com/2019/02/10/21-peer-reviewed-articles-on-the-adverse-health-effects-of-wind-turbine-noise/
Industrial wind turbines can harm human health if sited too close to residents. Harm can be avoided if IWTs are situated at an appropriate distance from humans. Owing to the lack of adequately protective siting guidelines, people exposed to IWTs can be expected to present to their family physicians in increasing numbers. The documented symptoms are usually stress disorder-type diseases acting via indirect pathways and can represent serious harm to human health. o Nissenbaum - Effects of industrial wind turbine noise on sleep and health - 2012 We conclude that the noise emissions of IWTs disturbed the sleep and caused daytime sleepiness and impaired mental health in residents living within 1.4 km of the two IWT installations studied. Industrial wind turbine noise is a further source of environmental noise, with the potential to harm human health.	<u>Jeffery - Adverse health effects of industrial wind turbines - 2013</u>
<p>Wind turbine noise has a particularly annoying quality to humans and disturbs sleep, which is linked to risk of cardiovascular disease and learning performance. It is understood that even if noise does not cause complete awakening, arousal is enough to result in fatigue, headaches, and poor memory.</p> <p>Noise is more likely to cause depression and disturbance to 15% of the population who is more sound-sensitive, especially those with brain injury, dyslexia or psychological disorders.</p> <p>Low frequency noise from turbines in mountainous areas has been shown to be heard from further distances.</p> <p>35%-72% of residents living within 400-800 meters (1300-2600 feet) of turbines in three studies reported being able to hear turbine noise, and the most common complaint was sleep disturbance.</p>	<p><u>Hanning - Turbine Noise Seems to Affect Health Adversely 2012</u></p> <p>Full version of this article is included in above link (in row 1), <u>BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF SOUTH DAKOTA IN THE MATTER OF THE APPLICATION BY DAKOTA RANGE I, LLC AND</u></p> <p>This particular source is an in depth analysis of a dozen or so studies done on the effects of turbines, comparing the data</p>

Pierpoint studies done in 2009, detailed case studies of families around the world who have been affected by turbines, reported that 7 of 10 children showed decline in their performance at school.

Numerous separate studies done in completely separate continents reflect startlingly similar resident complaints: headaches, anxiety, poor sleep, trouble with concentration and memory.

"The noise of wind turbines has been likened to a "passing train that never passes" which may explain why wind turbine noise is prone to cause sleep disruption." (10)

"...three leading members of the National Institute of Environmental Health Sciences, part of the US National Institutes of Health, state: "Wind energy will undoubtedly create noise, which increases stress, which in turn increases the risk of cardiovascular disease and cancer" (6). "Project WINDFARM perception further found that "Three out of four participants declare that swishing or lashing is a correct description of the sound from wind turbines" (18).

"The sleep, because it is broken, is unrefreshing resulting in sleepiness, fatigue, headaches and poor memory and concentration (Martin 1997), many of the symptoms of "wind turbine syndrome" (9).

15% of people are noise sensitive, and these people are more likely to be found in rural areas: "The noise sensitive are more likely to have stress related disorders, anxiety, headaches etc and poor sleep than the average." Noise sensitivity is more likely in those with brain injury and psychological disorders such as dyslexia and increased community noise may exacerbate depression in susceptible individuals." (12)

"It has been suggested that mountainous areas may allow low frequency noise to travel further" (15)

Pierpoint studies reported that "Of particular concern were the observed effects on children, include toddlers and school and college aged children. Changes in sleep pattern, behaviour and academic performance were noted. 7 of 10 children had a decline in their school performance while exposed to wind turbine noise which recovered after exposure ceased" (22).

A survey that led to the Japanese Environment Ministry to investigate potential health effects of wind turbine noise reported that 8% of turbine locations had received complaints directed to state and local authorities, and 90% of respondents complained of health problems including insomnia, headaches, dizziness, and buzzing in the ear. (24-25)

and synthesizing effects reported by respondents. The author is a renowned sleep specialist.

<p>The public health burden from environmental noise Exposure to noise can lead to auditory and non auditory effects on health. Through direct injury to the auditory system, noise leads to auditory effects such as hearing loss and tinnitus. Noise is also a nonspecific stressor that has been shown to have an adverse effect on human health, especially following long-term exposure. These effects are the result of psychological and physiological distress, as well as a disturbance of the organism's homeostasis and increasing allostatic load (Basner et al., 2014). This is further outlined in the WHO narrative review of the biological mechanisms of nonauditory effects (Eriksson et al., 2018)....</p> <p>Sufficient information was deemed available to quantify the burden of disease from environmental noise (our emphasis) for cardiovascular disease, cognitive impairment in children, sleep disturbance, tinnitus and annoyance.</p>	<p>https://stopthesethings.files.wordpress.com/2018/10/who-noise-guidelines-2018.pdf</p>
<p>For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB Lden, as wind turbine noise above this level is associated with adverse health effects. To reduce health effects, the GDG conditionally recommends that policy-makers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure.</p>	<p>https://stopthesethings.files.wordpress.com/2018/10/who-noise-guidelines-2018.pdf - page 77</p>
<p>The WHO guidelines for community noise recommend less than 30 A-weighted decibels (dB(A)) in bedrooms during the night for a sleep of good quality and less than 35 dB(A) in classrooms to allow good teaching and learning conditions.</p> <p>The WHO guidelines for night noise recommend less than 40 dB(A) of annual average (L_{night}) outside of bedrooms to prevent adverse health effects from night noise.</p>	<p>http://www.euro.who.int/en/health-topics/environment-and-health/noise/data-and-statistics</p>
<p>The noise emitted from wind turbines has other characteristics, including the repetitive nature of the sound of the rotating blades and atmospheric influence leading to a variability of amplitude modulation, which can be a source of above average annoyance (Schäffer et al., 2016). This differentiates it from noise from other sources and has not always been properly characterized. Standard methods of measuring sound, most commonly including A-weighting, may not capture the low-frequency sound and amplitude modulation characteristic of wind turbine noise (Council of Canadian Academies, 2015).</p>	<p>https://stopthesethings.files.wordpress.com/2018/10/who-noise-guidelines-2018.pdf</p>
<p>The noise emitted from wind turbines has other characteristics, including the repetitive nature of the sound of the rotating blades and atmospheric influence leading to a variability of amplitude modulation, which can be a source of above average annoyance (Schäffer et al., 2016). This differentiates it from noise from other sources and has not always been properly characterized. Standard methods of measuring sound, most commonly including A-weighting, may not capture the low-frequency sound and amplitude modulation characteristic of wind turbine noise (Council of Canadian Academies, 2015).</p>	<p>https://stopthesethings.files.wordpress.com/2018/10/who-noise-guidelines-2018.pdf</p>

<p>“Industrial wind turbines (IWTs) are a new source of noise in previously quiet rural environments. Environmental noise is a public health concern, of which sleep disruption is a major factor... We conclude that the noise emissions of IWTs disturbed the sleep and caused daytime sleepiness and impaired mental health in residents living within 1.4 km of the two IWT installations studied. Industrial wind turbine noise is a further source of environmental noise, with the potential to harm human health. Current regulations seem to be insufficient to adequately protect the human population living close to IWTs. Our research suggests that adverse effects are observed at distances even beyond 1 km.”</p>	<p>http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2012;volume=14;issue=60;spage=237;epage=243;aualast=Nisenbaum</p>
<p>Annoyance and Nuisance - Sleep deprivation leads to disease.</p> <p>The <u>EIS 2014 TetraTech Noise Assessment</u> comes right out and says the Na Pua Makani wind farm noise will exceed the <u>ANSI S12.9 Part 4 (ANSI 2005) Annex D threshold for onset of adverse effects / annoyance / nuisance</u> in the residential area of Kahuku</p>	<p>EIS 2014 TetraTech Noise Assessment</p> <p>Here is the courts full opinion. https://caselaw.findlaw.com/tx-court-of-appeals/1281093.html</p> <p>This is a recent case in Texas - Does the Aesthetic Impact of Wind Turbines Constitute a Nuisance? https://agrilife.org/texasaglaw/2019/03/11/do-wind-turbines-constitute-a-nuisance-by-aesthetic-damage/</p>
<p>More studies need to be done to determine a link between turbines and negative health effects. “Concerns about the environmental effects on birds, electronic signals, noise pollution, and long-term storage need to be evaluated.”</p>	<p>https://pubs.usgs.gov/sir/2011/5036/sir2011-5036.pdf</p>
<p>“Methodologically robust longitudinal studies with large samples investigating the quantitative relationship between noise from wind turbines and health effects are needed.”</p> <p>W.H.O. World Health Organization European Region 2018 Environmental Noise Guidelines p.77 suggested a noise limit of no more than 45dB for Wind Turbines p.80 All studies found a positive association between exposure to wind turbine noise and hypertension.</p>	<p>https://stopthesethings.files.wordpress.com/2018/10/who-noise-guidelines-2018.pdf</p>
<p>The Falmouth, MA turbines were taken down due to nuisance.</p> <p>The nuisance claim was raised by the Funfars, neighbors to the town-owned turbines, who alleged harms from turbine noise including stress, anxiety, insomnia, and nausea, and deprivation of the use and enjoyment of their land as they could not stand to be outside for extended periods</p>	<p>https://patch.com/massachusetts/falmouth/falmouth-nuisance-wind-turbines-offshore-wind-study</p>


Wind turbine noise is causing noise annoyance, and possibly also sleep disturbance, which means that one cannot completely rule out effects on the cardiovascular system after prolonged exposure to wind turbine noise, despite moderate levels of exposure.	https://iopscience.iop.org/article/10.1088/1748-9326/6/3/035103/meta
High levels of annoyance in a non-trivial percentage of persons, with annoyance associated with sound from wind turbines expected to contribute to stress-related health impacts in some persons	Nissenbaum (2013)
"Wind turbines produce sound that is capable of disturbing local residents and is reported to cause annoyance, sleep disturbance, and other health-related impacts."	https://journals.sagepub.com/doi/abs/10.1177/0270467612455734
Results: Industrial wind turbines produce sound that is perceived to be more annoying than other sources of sound. Reported effects from exposure to IWTs are consistent with well-known stress effects from persistent unwanted sound. Conclusion: If placed too close to residents, IWTs can negatively affect the physical, mental and social well-being of people. There is sufficient evidence to support the conclusion that noise from audible IWTs is a potential cause of health effects. Inaudible low-frequency noise and infrasound from IWTs cannot be ruled out as plausible causes of health effects	Canadian Journal of Medicine https://howgreenisthis.org/wp-content/uploads/2014/11/iwt-adverse-health-effects-Krogh-and-Horner.pdf
France academy of medicine recognizes pathophysiological parameters of chronic sound trauma and prohibits construction of IWT of 2.5MW or greater less than 1,500m (4,921ft) from homes. detail: "the only risk currently likely for the population is that of chronic sound trauma, the pathophysiological parameters of which are well known, and whose the impact depends directly on the distance separating the wind turbine from the living areas of the neighboring populations" "as a precautionary measure, the construction of wind turbines with a power greater than 2.5 MW located less than 1,500 meters from homes is suspended, - article 98 of the law of July 2, 2003 is amended, so that wind turbines, as soon as they exceed a certain power, are considered as industrial installations, and that their establishment is henceforth subject to a specific regulation taking into account the very particular noise pollution that they induce"	http://www.academic-medecine.fr/le-retentissement-du-fonctionnement-des-eoliennes-sur-la-sante-de-lhomme/
	<u>Representative Sean Quinlan's JABSOM Study Prospectus</u>

Shadow Flicker

Detail	Source
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<p>Farmers and Farmer's residences will be impacted the most by shadow flicker.</p> <p>Collectively, receptors with predicted shadow flicker of more than 30 - Na Pua Makani Wind Project 4-258 FINAL ENVIRONMENTAL IMPACT STATEMENT hours per year would experience shadow for 2 to 8 months of the year (theoretical maximum of 47-248 days with shadow per year), with maximum shadow flicker times per day ranging from 17 minutes to 2 hours and 20 minutes (Table 4.18-3).</p>	<p>https://dlnr.hawaii.gov/ld/files/2016/07/Na-Pua-Wind-Project-HEPA-Final-EIS.pdf (page 4-258 - 4-259)</p>
	<p><u>"THIS IS OUR LIFE" : What shadow-flicker looks like in Kingston, MA...</u></p>
	<p><u>'Shadow Flicker' And Lost Sleep: Are Kahuku Wind Turbines Too Close To Homes?</u></p>
<p>Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them Neurosciences Institute Aston University, Birmingham, United Kingdom; and †Department of Psychology, University of Essex, Colchester, United Kingdom</p> <p>Flicker from turbines that interrupt or reflect sunlight at frequencies greater than 3 Hz poses a potential risk of inducing photosensitive seizures.</p> <p>The layout of wind farms should ensure that shadows cast by one turbine upon another should not be readily visible to the general public. The shadows should not fall upon the windows of nearby buildings. The specular reflection from turbine blades should be minimized.</p>	<p>https://puc.sd.gov/commission/dockets/electric/2019/EL19-027/testimony/crownridge/cos13.pdf</p> <p>*Graham Harding, *Pamela Harding, and †Arnold Wilkins *</p>

Infrasound and VAD: Vibroacoustic disease

Claim	Detail	Source
<p>Salt and Hullar's study produce evidence that infrasound has a physiological effect on the inner ear through stimulation of the outer hair cells.</p>	<p>Other sensory cells or structures in the inner ear, such as the outer hair cells, are more sensitive to infrasound than the inner hair cells and can be stimulated by low frequency sounds at levels below those that are heard. The</p>	<p>Salt and Hullar, <u>Responses of the ear to low frequency sounds ... - NCBI - NIH</u>  www.ncbi.nlm.nih.gov/pubmed 2010</p>

	concept that an infrasonic sound that cannot be heard can have no influence on inner ear physiology is incorrect.	
Acousticians studying infrasound experienced adverse health effects similar to those reported by residents.	An acoustical study was conducted to investigate the presence of infrasonic and low-frequency noise emissions from wind turbines located in Falmouth, Massachusetts, USA. During the study, the investigating acousticians experienced adverse health effects consistent with those reported by some Falmouth residents. The authors conclude that wind turbine acoustic energy was found to be greater than or uniquely distinguishable from the ambient background levels and capable of exceeding human detection thresholds.	https://journals.sagepub.com/doi/abs/10.1177/0270467612455734
Nina Pierpoint, MD, PhD psychiatry and child development specialist... Conducted a case study on health effects of close proximity to IWT's and compared to other studies finding consistent cases of disturbed vestibular organs.	“Clinical evidence is unambiguous that low frequency noise and infrasound profoundly disturb the body’s organs of balance motion and position sense (called “vestibular organs”)” “Sensory systems change brain functioning.”	https://waubrafoundation.org.au/wp-content/uploads/2013/06/Pierpont-DrNina-sub-Fed-Senate-Inquiry.pdf
University Hospital of the Ludwig-Maximilians University Munich, Germany, in agreement with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans conducted study claims: Low-frequency sound affects active micromechanics in the human inner ear.	Conclusion: The results of this study clearly indicate that there is a pronounced discrepancy between the unobtrusive perception of LF sound, reflected in their low sensation levels and the physiological responses of the cochlea following the LF sound exposure.	https://royalsocietypublishing.org/doi/pdf/10.1098/r sos.140166
Dr. Sarah Laurie Infrasound has physiological effect on outer hair cells (OHC) “if you stimulate the outer hair cells in the inner ear, some of the afferent fibres will take	“There has been pretence that there is no evidence of harm at the levels of infrasound and low-frequency noise being emitted. This is untrue. There is an extensive body of research conducted	https://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;db=COMMITTEES;id=committees/commsen/b1a80440-3bf3-438c-8a68-471db69711a3/00

<p>that sound energy and translate it into pulses into the brain that stimulate the alerting response in the brain”</p>	<p>by NASA and the US Department of Energy 30 years ago, which: established direct causation of sleep disturbance and a range of physiological effects euphemistically called ‘annoyance’,”</p>	<p>08;query=Id:%22committees/commsen/b1a80440-3bf3-438c-8a68-471db69711a3/0000%22</p>
<p>Prof. Simone Kuhn of the Medical Center Hamburg Eppendorf published a peer reviewed medical study of Infrasound(IS) exposure using MRI images that proved the physiological effects and neural responses within brain areas important to auditory processing, emotional control, and autonomic control.</p>	<p>The results of the present study can be summed up in the following way: Prolonged IS exposure near the participants’ individual hearing threshold led to higher local connectivity in three distinct brain areas–rSTG, ACC and rAmyg–, while no such effect was observed for stimulation above the hearing threshold. Our data also shows that near-threshold IS was associated with connectivity changes on the network level, emphasizing the role of the rAmyg in IS processing. To our knowledge, this study is the first to demonstrate that near-threshold IS does not only produces physiological effects, but that the neural response involves the activation of brain areas, which are important for auditory processing but also for emotional and autonomic control. These findings thus allow us to reflect on how (sub)-liminal IS could give rise to a number of physiological as well as psychological health issues, which until now have only been loosely attributed to noise exposure in the low- and very low-frequency spectrum.</p>	<p>https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5389622/</p>
<p>Infrasound at high levels of exposure may have adverse biological consequences causing annoyance, aural pain or resulting in the rupture of the eardrum.</p>		<p>https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335014/RCE-14_for_web_with_security.pdf</p>

<p>"A five megawatt wind farm would possibly generate a detectable infrasound signal even from a distance of twenty kilometres." Dr. Lars Ceranna, Institute for Geosciences and Natural Resources, Germany</p>	<p>Obviously, modern wind turbines with heights of about 80 m and larger as well as minimum 600 kW power 20 km to the north of Hannover near Schwarmstedt using modern wind turbines with hub heights of about 80 m and larger as well as minimum 600 kW power 20 km to the north of Hannover, near Schwarmstedt, using output can emit aerodynamic noise signals in the 1 to 2 Hz frequency range which can be recorded at distances of more than 10 km. At such large distances the SPL still exceeds the background noise level. Considering wind farms of 1.5 MW turbines the computed SPL of the second BPH the signal amplitudes exceed background noise level even at distances larger than 30 km.</p>	<p>https://www.bgr.bund.de/DE/Themen/Erdbeben-Geofachrdungsanalysen/Seismologie/Downloads/infraschall_WKA_Poster.pdf?__blob=publicationFile&v=2</p>
<p>IT professor discovers infrasound can cause physiological effects</p>	<p>Vic Tandy: IT professor discovered infrasound at 19Hz has a range of physiological effects, including feelings of fear and shivering</p>	<p>https://www.youtube.com/watch?v=vwWNx3OJvu0&feature=youtu.be</p>
<p>Extensive research study conducted on DOE/NASA MOD-1 wind turbine by Solar Energy Research Institute and US Dept. of Energy after complaints of indoor vibrations and annoyance.</p>	<p>This report summarizes extensive research by staff of the Solar Energy Research Institute and its subcontractors conducted to establish the origin and possible amelioration of acoustic disturbances associated with the operation of the DOE/NASA MOD-1 wind turbine installed near Boone, North Carolina.</p> <p>Feb 1985</p> <p>Nearby residents were annoyed by the low-frequency, acoustic impulses propagated into the structures in which the complainants lived.</p> <p>The noise was more noticeable within the homes because of the dynamic amplification and</p>	

	resonances created in the internal acoustic pressure field because of the interaction between the external transient acoustic loading and the lightly damped elastic response of the residential structure.	
	"We can definitely say that under these acute conditions infrasound really does have a distinct effect on heart muscle tissue. Both series of tests have revealed a clear reduction in heart muscle strength." Christian Vahl is Director of Cardiac, Thoracic, and Vascular Surgery at Mainz University Medical Center.	https://www.youtube.com/watch?v=yvWNx3OJyu0&feature=youtu.be
	The pilot study carried out in Satakunta and Northern Ostrobothnia in Finland shows that the damage caused by infrasound from wind power plants will only decrease significantly more than 15 kilometres away from wind turbines." Finnish Association for Environmental Health	https://syte.fi/2019/01/10/pilottitutkimus-osoittaa-infraäänihaitan-vahenevan-merkittävasti-vasta-vli-15-kilometrin-paassa-tuulivoimaloista/
	"This is a pioneering field of science, still in its infancy and urgently requiring scientists from multidisciplinary areas of study because, ultimately, the health of human populations and their offspring must be protected." Dr. Mariana Alves-Pereira holds a B.Sc. in Physics (State University of New York at Stony Brook), a M.Sc. in Biomedical Engineering (Drexel University) and a Ph.D. in Environmental Sciences (New University of Lisbon)..	https://www.intechopen.com/online-first/acoustics-and-biological-structures https://www.youtube.com/watch?v=ZXCZ3OyklrE&t=101s
		https://www.fws.gov/southwest/es/documents/R2ES/LitCited/LPC_2012/National_Research_Council_2007.pdf
		https://docs.wind-watch.org/James-wind-turbine-infrasound-low-frequency-warning-signs-not%20heard.pdf

	<p>Results: Industrial wind turbines produce sound that is perceived to be more annoying than other sources of sound. Reported effects from exposure to IWTs are consistent with well-known stress effects from persistent unwanted sound.</p> <p>Conclusion: If placed too close to residents, IWTs can negatively affect the physical, mental and social well-being of people. There is sufficient evidence to support the conclusion that noise from audible IWTs is a potential cause of health effects. Inaudible low-frequency noise and infrasound from IWTs cannot be ruled out as plausible causes of health effects</p>	<p>Canadian Journal of Rural Medicine https://howgreenisthis.org/wp-content/uploads/2014/11/iwt-adverse-health-effects-Krogh-and-Horner.pdf</p>
<p>High powered, low frequency sound from about 30 Hz to about 100 Hz (just beyond infrasound) causes the following biological effects: fatigue, blurred vision, bowel spasms, pain or damage to internal organs, feelings of fullness in the chest cavity, chest wall vibration, difficulty breathing, difficulty swallowing, choking, and respiratory impairment.</p> <p>Infrasound causes a variety of psychological effects depending on the frequency and power level. It can cause the following: loss of concentration, disgust, apathy, sadness, depression, fear, anxiety, and panic attacks.</p>	<p>Infrasound</p> <p>from 1 to about 250 Hz the pain/damage threshold seems to increase with frequency as well as power. Other than that, power is the critical factor which causes the damage, while the frequency determines what type of damage occurs...if the frequency is increased, more damage can occur. Infrasound travels great distances and easily passes through most buildings and vehicles. It is normally sensed by the ears, but at high power levels it can couple with the body and be felt as vibrations. Natural examples of this include: avalanches, earthquakes, volcanoes, and waterfalls. Whales, elephants, hippopotamuses, and rhinoceros use infrasound to communicate over great distances which includes hundreds of miles for whales. An electronic example would be a large sub-woofer. Infrasound is said to be superior to ultrasound because it retains its frequency when it couples with the human body.</p>	<p>https://hearinghealthmatters.org/journalresearchposts/files/2016/09/16-10-21-Wind-Turbine-Noise-Post-Publication-Manuscript-HH-TM-Punch-James.pdf</p>

	<p>From about 100 to 140 decibels infrasound causes a variety of biological symptoms depending on the frequency and power level. Basically, the higher the power level, the greater the damage. The effects include: fatigue, pressure in the ears, visual blurring, drowsiness, imbalance, disorientation, vibration of internal organs, severe intestinal pain, nausea, and vomiting. Higher power levels can liquefy bowels, and resonate the internal organs causing death. Infrasound can also cause feelings of pressure in the chest, choking, irregular breathing patterns, and respiratory incapacitation.</p> <p>According to the <i>Acoustic Weapons Prospective Assessment</i> article, which appeared in the volume 9, 2001 issue of <i>Science and Global Security</i>, infrasound can produce localized earthquakes. A large room within a building can act as a resonance chamber to upset the foundation causing a miniature earthquake.</p>	
		<p><u>South Dakota PUC docket with Expert Testimony</u> <u>MARIANA ALVES-PEREIRA</u></p>

General health, quality of life / annoyance and nuisance from IWT Claims

Detail	Source
	<p><u>Impacts of Na Pua Makani Windfarm on Human Health and the Environment</u> - Impacts of Na Pua Makani Wind Farm on Human Health - Michael Richards - University of Hawaii Windward Community College</p>
Close proximity to Industrial Turbines results in decreased quality of life and physical health.	<p>https://docs.wind-watch.org/Residential-proximity-wind-turbine-health-exposure.pdf</p>

<p>"Results suggest that proximity to wind turbines is inversely associated with the environment domain quality of life score (b 1/4 \square1.23, SE 1/4 0.145, p 1/4 0.046). This association suggests that every kilometre a person lives further away from a wind turbine is associated with a 1.23 point increase in score on the environmental health quality of life scale (Table I). A higher score is indicative of a higher environmental quality of life."</p> <p>"There was a positive association between distance to wind turbines and the scores for the physical health quality of life domain"</p>	<p><u>Resolution 19-305</u> refers to 2018 U. of Toronto Study above</p>
<p>More studies need to be done to determine a link between turbines and negative health effects.</p> <p>"Concerns about the environmental effects on birds, electronic signals, noise pollution, and long-term storage need to be evaluated."</p>	<p>https://pubs.usgs.gov/sir/2011/5036/sir2011-5036.pdf</p>
<p>More studies need to be done to determine how to best protect residents from detrimental health effects of industrial turbines..</p> <p>"The authors emphasize the need for epidemiological and laboratory research by health professionals and acousticians concerned with public health and well-being to develop effective and precautionary setback distances for industrial wind turbines that protect residents from wind turbine sound."</p>	<p>https://journals.sagepub.com/doi/abs/10.1177/0270467612455734</p>
	<p>https://journals.sagepub.com/doi/abs/10.1177/0270467611417852</p>
<p>"Assessing the effects of wind turbines on human health is an emerging field and conducting further research into the effects of wind turbines (and environmental changes) on human health, emotional and physical, is warranted."</p>	<p>https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-10-78</p>
	<p>https://www.masterresource.org/windpower-health-effects/europe-world-health-organization-wind-effects/</p>
<p>"We have described multiple ways in which infrasound and low-frequency sounds could affect the ear and give rise to the symptoms that some people living near wind turbines report. If, in time, the symptoms of those living near the turbines are demonstrated to have a physiological basis, it will become apparent that the years of assertions from the wind industry's acousticians that "what you can't hear can't affect you" or that symptoms are psychosomatic or a nocebo effect was a great injustice."</p>	<p>http://www.windturbinesyndrome.com/wp-content/uploads/2014/04/Salt-et-al.-on-Wind-Turbine-Syndrome.pdf</p>

"The analyses reveal the statistically significant reduction of the pulse rate from the initial level 73 [1/min] to 67 [1/min]."	Pierpont (2009)
Sleep disturbance; headache; Visceral Vibratory Vestibular Disturbance (VVVD); dizziness, vertigo, unsteadiness; tinnitus; ear pressure or pain; external auditory canal sensation; memory and concentration deficits; irritability and anger; and fatigue and loss of motivation	Leventhall (2003) & Kasprzak (2014)
Vibration of bodily structures (chest vibration), annoyance (especially in homes), perceptions of unpleasantness (pressure on the eardrum, unpleasant perception within the chest area, and a general feeling of vibration), sleep disturbance (reduced wakefulness), stress, reduced performance on demanding verbal tasks, and negative biological effects that include quantitative measurements of EEG activity, blood pressure, respiration, hormone production, and heart rate	Havas & Colling (2011)
Difficulty sleeping, fatigue, depression, irritability, aggressiveness, cognitive dysfunction, chest pain/pressure, headaches, joint pain, skin irritations, nausea, dizziness, tinnitus, and stress	Horner (2013) & Paller et al (2013)
Headaches, nausea, tinnitus, vertigo, and worsened sleep	Jeffery et al (2013)
Sleep disturbance; subjective complaints such as headaches, fatigue, temporary feelings of dizziness, and nausea; objective complaints such as vomiting, insomnia, and palpitations; annoyance; and reduced quality of life (QoL)	Jeffery et al (2014)
Negative impacts on the physical, mental and social well-being of people	Krogh et al (2012)
Annoyance (regarded as an adverse health effect associated with stress), sleep disturbance, headaches, difficulty concentrating, irritability, fatigue, and a variety of more-serious ailments	Minnesota Department of Health (2009)
Annoyance, reduced quality of life, sleeplessness, and headache	Howe Gastmeier Chapnik Limited (2010)
Sleep disturbances/sleep deprivation and the multiple illnesses that cascade from chronic sleep disturbance, which include cardiovascular diseases mediated by chronically increased levels of stress hormones, weight changes, and metabolic disturbances (including the continuum of impaired glucose tolerance through diabetes); psychological stresses that can result in cardiovascular disease, chronic depression, anger, and other psychiatric symptomatology; headaches, auditory and vestibular system disturbances; an increased requirement for and use of prescription medication; tinnitus; and vertigo	Nissenbaum et al (2012)
Increased sleep disruption, reduced mental health	Thorne (2013)

Sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic attack episodes	Pawlaczyk - Luszczynska et al (2005)
Problems with vision, concentration, and continuous and selective attention (especially in persons who are highly sensitive to low-frequency noise)	Pedersen (2011)
Annoyance (both outdoors and indoors), statistically related to SPLs; sleep interruption, diabetes, and tinnitus (at one of three test sites); annoyance outdoors, significantly related to sleep interruption, tension, stress, irritability (at all three sites), headache (at two sites), and undue fatigue (at one site); annoyance indoors, significantly related to sleep interruption (at all three sites), and to diabetes, headache, undue fatigue, tension, stress, and irritability (at one of three sites)	Roberts & Roberts (2013)
Vibration or fatigue, annoyance or unpleasantness	Shepherd & Billington (2011)
Annoyance, which has been linked to increased levels of psychological distress, stress, difficulty falling asleep, and sleep interruption	Taylor (2013)
Annoyance, stress, sleep disturbance, interference with daily living, headache, irritability, difficulty concentrating, fatigue, dizziness, anxiety, and reduced QoL	Ambrose et al (2012) & Rand et al (2011)
Dizziness, irritability, headache, loss of appetite, fatigue, inability to concentrate, a need to leave the home, and a preference for being outdoors (during investigations of WTN by seasoned researchers, including acousticians)	Thorne (2011)
Sleep disturbance, anxiety, stress, and headaches	Palmer (2013)
Negative impacts on sleep, job stability, social relationships, caregiving, pursuit of hobbies, leisure, learning, and overall health (based on interviews of residents four years after living near operational wind turbines)	Castelo Branco & Alves-Pereira (2004) & Castelo Branco (1999)
Vibroacoustic disease, described as occurring only after extensive exposure to high levels of infrasound	
	<i>Wind Turbine Syndrome: A Report on a Natural Experiment.</i> Pierpont, Nina. 2009. Only abstract available. Book requested.
	<i>A Review of Published Research on Low Frequency Noise and its Effects.</i> Levelthall. 2003.

	Book requested.
	http://przyrbwn.icm.edu.pl/APP/PDF/118/a118z1p20.pdf
	<i>Wind Turbines Make Waves: Why Some Residents Near Wind Turbines Become Ill.</i> Havas & Colling. 2011 See article.
	The Influence of Infrasonds on the Electrocardiograph Patterns in Humans C. Kasprzak* Department of Mechanics and Vibroacoustics, Faculty of Mechanical Engineering and Robotics
	https://www.windturbinesyndrome.com/img/WindTurbineNoise.pdf
<p>Key points</p> <ul style="list-style-type: none"> • A wide range of environmental influences causes biological effects. 'Biological effect' does not equal 'health hazard'. Special research is needed to identify and measure health hazards. • At low frequencies, external electric and magnetic fields induce small circulating currents within the body. In virtually all ordinary environments, the levels of induced currents inside the body are too small to produce obvious effects. • The main effect of radiofrequency electromagnetic fields is heating of body tissues. • There is no doubt that short-term exposure to very high levels of electromagnetic fields can be harmful to health. Current public concern focuses on possible long-term health effects caused by exposure to electromagnetic fields at levels below those required to trigger acute biological responses. • WHO's International EMF Project was launched to provide scientifically sound and objective answers to public concerns about possible hazards of low level electromagnetic fields. • Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health. • The focus of international research is the investigation of possible links between cancer and electromagnetic fields, at power line and radiofrequencies. 	https://www.who.int/peh-emf/about/WhatIsEMF/en/index1.html

The wind machine shall be operated so that no disruptive electromagnetic interference is caused. If it can be demonstrated to the director that the system is causing harmful interference, the operator shall promptly mitigate the interference. (107)	http://hlsahawaii.org/Files/Land_Use_Ordinance.pdf
	<u>THE RESULTS OF AN ACOUSTIC TESTING PROGRAM CAPE BRIDGEWATER WIND FARM</u>
An acoustical study was conducted to investigate the presence of infrasonic and low-frequency noise emissions from wind turbines located in Falmouth, Massachusetts, USA. During the study, the investigating acousticians experienced adverse health effects consistent with those reported by some Falmouth residents. The authors conclude that the rapid onset of adverse health effects during the study confirms that wind turbines can harm humans if placed too close to residents.	<u>Ambrose - Wind turbine acoustic investigation - Infrasound and low-frequency noise - A case study 2012</u>
There is overwhelming evidence that wind turbines cause serious health problems in nearby residents, usually stress-disorder-type diseases, It is always possible that further research will reveal that, under certain circumstances, turbines can be sited near people's homes with minimal health risk. Such is always possible for any exposure, given the nature of science (open to additional information) and changing technology. But our current knowledge indicates that there are substantial health risks from the existing exposure, and we do not know how to reduce those risks other than by keeping turbines several kilometers away from homes. Dismissal of health effects cannot be seen as honest disagreements about the weight of the evidence. o Salt - Infrasound from wind turbines could affect humans 2011 Based on our current knowledge of how the ear works, it is quite possible that low-frequency sounds at the levels generated by wind turbines could affect those living nearby. We can conclude that based on well-documented knowledge of the physiology of the ear and its connections to the brain, it is scientifically possible that infrasound from wind turbines could affect people living nearby.	<u>Phillips - Properly interpreting the epidemiologic evidence about health effects of industrial wind turbines on nearby residents 2011</u>
	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114183#abstract0
	https://iopscience.iop.org/article/10.1088/1748-9326/6/3/035103#undefined

Setbacks

Detail	Source
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	Proximity
"Wyoming officials can only issue permits for wind turbines that are at a distance from a home of at least five-and-a-half times the height of the tower or 1,000 feet, whichever is greater.	https://law.justia.com/codes/wyoming/2012/title18/chapter5/section18-5-504/
Kentucky requires facilities to be at least 1,000 feet from the property boundary and 2,000 feet from any residential neighborhood, school, hospital or nursing home facility.	https://codes.findlaw.com/ky/title-xxiv-public-utilities/ky-rev-st-sect-278-704.html
2 mile set back recommended County of Umatilla Oregon passed an ordinance to have wind turbines setback 2 miles from rural communities for peace, health and safety.	Ordinance 2012-13 The board of commissioners of Umatilla County
List of governments and jurisdictions that have setback laws.	https://www.lincoln.ne.gov/city/plan/dev/wind/working-group-info/chapman-6.pdf?fbclid=IwAR1JkCewYxmtG-Xu88q9DhtAJ0kLnrN0QRUroJJzAMCinOpLG6Wr8hanSM
	<ol style="list-style-type: none"> 1. Advisory Boards UK Noise Association 5,280 ft. 2. French Academy of Medicine 4,921 ft. from residences 3. National Research Council 2,640 ft. 4. Turbine Manufacturers Volkswind 1,640 ft. (US) 3,280 (Germany) 5. Vestas Safety Manual 1,300 ft.
Catarunk, Maine 7,920 ft.	
Moscow, Maine 7,920 ft. Haut-Saint-Laurent, Montérégie, Québec 6,562 ft.	
Fayette County, Pennsylvania 6,000 ft.	
Carteret County, North Carolina 5,280 ft. from all abutting property lines	
Frankfort, Maine 5,280 ft. from property line	
Umatilla County, Oregon 5,280 ft. from "unincorporated community"	
Mason County, Kentucky 5,280 ft. from property line	

Trempealeau County, Wisconsin 5,280 ft. from inhabited structures	
Hillsdale County, Michigan 5,280 ft. from residences	
Sumner, Maine 5,280 ft. from property line	
Newport, North Carolina 5,000 ft. from neighboring property lines	
Ellis County, Kansas 4,921 ft. from rural residences	
Rumford, Maine 4,000 ft. from property line	
Clifton, Maine 4,000 ft. from occupied structures	
San Diego, California 3,937 ft. from residences	
Halifax, Nova Scotia 3,281 ft. from habitable building	
Claybanks Township, Michigan 3,000 ft. from property line	
Cape Vincent, New York 2,953 ft.	
Potter County, Pennsylvania 2,900 ft.	
Wareham, Massachusetts 2,800 ft. from residences	
Goodhue County, Minnesota 2,700 ft. from non-participants	
Roanoke County, Virginia 2,640 ft. from residences	
Tipton County, Indiana 2,640 ft. from residences	
Union Township, Wisconsin 2,640 ft. from residences	
Perry, New York 2,640 ft. from residences	
Rock County, Wisconsin 2,640 ft.	
Buckland, Massachusetts 2,640 ft. from residences	
Granville, Pennsylvania 2,500 ft. from property line	

Charlton, Massachusetts 2,500 ft.	
Allegany, New York 2,500 ft	
Because of widespread concerns about health and safety, many jurisdictions scattered around the United States and Canada have adopted larger setbacks in recent years. Some 65 governmental entities in 22 states moved to ban or restrict wind projects in 2015. The entities include 30 towns and 27 counties. Also, planning and development authorities covering 82 additional towns in VT moved to reject wind-energy projects.	https://www.lincoln.ne.gov/city/plan/dev/wind/working-group-info/chapman-6.pdf?fbclid=IwAR1JkCewYxmtG-Xu88q9DhtAJ0kLnrN0QRUroJJzAMCinOpLGC6Wr8hanSM - and - https://docs.google.com/spreadsheets/d/1aDW6eDm8cMpDkuc-7J68w2LfnNqzAenmZNSgldFq5yE/edit#gid=463687840
	https://townofyates.org/pdf/SetbackLawTable_Final_1-4-17.pdf
	https://www.ncsl.org/research/energy/state-wind-energy-siting.aspx
	City of Lincoln Nebraska reports and finding related to wind turbines. https://lincoln.ne.gov.aspx/city/main/search.aspx#s
	*Need to cull through this document to pull things out. There might be items that could be placed into other categories. https://docs.google.com/document/d/1hsvriQmmE5EPV9_ha13stk2nQcxa7KetzHJIoKNA5jk/edit?usp=sharing
<ul style="list-style-type: none"> - Residents in favor of extension - No adequate local laws regarding setbacks, health impacts, decommissionings, assessing values, or taxpayer indemnity - Would like to see ½ mile or mile setback from residences - Extension of Portland wind turbine Moratorium (Expires 12/26/19). Moratorium was due to permits and application for windmills 	https://www.wind-watch.org/news/2019/10/15/moratorium-on-portland-wind-turbines-may-get-extended/
<p>Page 10 of 65 - 2.7 In Case of Runaway Operation</p> <p>A runaway operation is almost impossible, as it would require several circumstances to happen at the same time.</p> <ul style="list-style-type: none"> • If a runaway operation should occur, the plant must be evacuated immediately by running upwind, and access to the surrounding area in a radius of at least 500 metres must be restricted. 	Vestas Health Safety Instruction 1000711

500 metres = 1640.42 feet	
	https://puc.sd.gov/commission/dockets/electric/2016/el16-022/publicinputmeeting/waynebietz.pdf

Green Energy Alternatives and Community Based Approaches to Planning for the Future

Detail	Source
David K. Meeting Recommendation	https://media4.manhattan-institute.org/sites/default/files/R-RB-1016.pdf Manhattan Institute research about decarbonization plans in the U.S., includes the implications of wind and solar needs if we are to complete this
David K. Meeting Recommendation	Bio Gas
David K. Meeting Recommendation	Slovenia Bio Mass
*David K. Meeting Recommendation	RIEP: Regional Integrated Energy Plan - Could take a couple of weeks <ul style="list-style-type: none"> • https://www.sciencedirect.com/science/article/pii/S1364032107001414 • Develop a model - Call for help (students) - Community meetings with folks to plan and envision - Events at the university - more community driven • Hydrological Data - deal with water use - Has to be in GIS or imported into GIS • 1st Alskans Institute Summer Internship program • Community Driven Approach • *Research - specific asks, he should pay for someone to do that model
*David K. Meeting Recommendation	Look up T.V. Ramachandra's work / papers for community based planning recommendations
*David K. Meeting Recommendation	Look up what Black Mesa Water Coalition has done as an example of community based approaches

*David K. Meeting Recommendation	Environmental Economics / Monetizing / Valuing Species and Environmental Resources
*David K. Meeting Recommendation	Look up Avac - 40 villages in Alaska - as an example of decentralized systems
Does not consider impacts on human health and wellbeing, ecological impacts, environmental justice/social justice, Native Hawaiian cultural rights, our fragile water systems, and economic impacts (including property value).	HEVI - https://energyoutlook.naseo.org/data/energymeetings/presentations/Harris1.pdf
Does not consider impacts on human health and wellbeing, ecological impacts, environmental justice/social justice, Native Hawaiian cultural rights, our fragile water systems, and economic impacts (including property value).	HAVEN - https://energy.hawaii.gov/energyplanning/overview

Qualitative / Anecdotal Accounts of Harm

Detail	Source
There I've given all thumbnails marked with UNTERTITEL English subtitles. The 9th thumbnail with the orange background is from a doctor. The second to last one on the bottom is myself. I am working on English subtitles for the rest.	German Association to Protect People and Animals from Industrial Noise - https://www.youtube.com/channel/UCkoHNBKOoDUQmkHzA0ox86w/videos

Bias in Their Studies - "25 studies"

Detail	Source
"The authors are actively working in the field of wind turbines and human health. Dr. Ollson has acted as an expert witness for wind power companies during a number of legal hearings."	https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-10-78 Knopper and Ollson 2011
Prepared for: American Wind Energy Association and Canadian Wind Energy Association December 2009	https://canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf Colby et al. 2009
The million-dollar question is whether the effects of wind turbine infrasound stimulation stay confined to the ear and have no other influence on the person or animal. At present, the stance of the wind industry and its acoustician advisors is that there are no consequences to long-term low-frequency and infrasonic stimulation. This is not based on studies showing that long-term stimulation to low-level infrasound has no infuFigure 1 : e sensory organ of the cochlea, showing inner and outer hair cell and neural anatomy. Redistribution subject to	http://www.windturbinesyndrome.com/wp-content/uploads/2014/04/Salt-et-al.-on-Wind-Turbine-Syndrome.pdf

ASA license or copyright; see <http://acousticalsociety.org/content/terms>. Download to IP: 128.252.16.235 On: Tue, 01 Apr 2014 14:11:4 | 23
ence on humans or animals. No such studies have ever been performed. Their narrow perspective shows a remarkable lack of understanding of the sophistication of biological systems and is almost certainly incorrect. As we consider below, there are many physiologic mechanisms by which long-term infrasound stimulation of the cochlea could have effects.

Wind Energy - Not Green

Claim	Detail	Source
Production, transportation, installation, operation, and the decommissioning process of wind turbines produces enormous amounts of toxic waste and carbon footprint.	"The consumption of fossil fuels and water during construction and decommissioning can be significant. Transportation of oversized equipment can be expensive and hazardous."	https://pubs.usgs.gov/sir/2011/5036/sir2011-5036.pdf
A great deal of concrete, steel, and precious metals are used to make the turbines which are then shipped miles away using tremendous amounts of diesel, gas, and fossil fuels.	<p>"Wind power currently requires the manufacturing of large pieces of equipment from foreign sources."</p> <p>"Wind turbines may also use rare earth minerals. These minerals are often located in countries with less stringent environmental standards than the United States, and mining these minerals can have negative effects on the environment. Producing the metals and other materials used to make wind turbines and the concrete used for their foundations requires energy that may have been produced by fossil fuels."</p>	<p>https://pubs.usgs.gov/sir/2011/5036/sir2011-5036.pdf</p> <p>https://www.eia.gov/energyexplained/wind/wind-energy-and-the-environment.php</p> <p>https://www.forbes.com/sites/jaredanderson/2017/03/01/you-cant-have-offshore-wind-power-without-petroleum/#449eeb94f2f7</p>
At the end of the turbine's life cycle the blades can not be recycled as they are made with fiberglass.	"A typical wind turbine is reported to contain 89.1 percent steel, 5.8 percent fiberglass, 1.6 percent copper, 1.3 percent concrete (primarily cement, water, aggregates, and steel reinforcement), 1.1 percent adhesives, 0.8 percent aluminum, and 0.4 percent core materials (primarily foam, plastic, and wood) by weight (U.S. Department of Energy, 2008)."	https://pubs.usgs.gov/sir/2011/5036/sir2011-5036.pdf

<p>It destroys pristine lands and forests while threatening endangered wildlife.</p>	<p>“Large areas of land are required for wind power plants. The land often cannot be utilized productively during construction or decommissioning.”</p> <p>“Most wind power projects on land require service roads that add to the physical effects on the environment.”</p>	<p>https://pubs.usgs.gov/sir/2011/5036/sir2011-5036.pdf</p> <p>https://www.eia.gov/energyexplained/wind/wind-energy-and-the-environment.php</p>
<p>Once it is erected, oils and coolants will be used to keep them spinning, night and day.</p>	<p>““Wind turbines are expensive pieces of machinery, and the lubrication system is critical to keeping that machine working well,” she said. “Many different parts of the wind turbine need to be lubrication with a range of lubricants greases to gearbox fluids to hydraulic oils.”</p>	<p>https://www.power-eng.com/2013/05/01/wind-turbine-lubrication-and-maintenance-protecting-investments/#gref</p>

	Keeping a wind turbine's gearbox properly lubricated is important in extending the life of a wind turbine, Patterson said. Petro-Canada's HARNEX 320, designed for use in wind turbine gearboxes, is a fully-synthetic oil designed to withstand the conditions wind turbines may face, from extreme temperatures to potential corrosion from saltwater for offshore wind turbines."	
The benefits do not outweigh the costs.	"Green energy projects must consider its impact on the environment, wildlife, and our communities. It must not come at the cost of these things just to reach it's 2045 Renewable Energy Goal. Wind companies claim to be green by powering thousands of homes through wind but this fails to account for wind turbine's impact in its totality...How can this be a positive environmental move if it results in destroying that environment?... This is not responsible green energy. The overall costs of wind turbines need to be considered. Without the federal subsidies and tax breaks, wind energy simply does not make sense. Wind energy is not green energy, it is greed energy."	Community member Sunny Unga (2019)
		http://www.ililani.media/2020/02/getting-rid-of-old-wind-turbine-blades.html?fbclid=IwAR2ya9I7zkPRkxty37s6pLSqPe5PxR4IMz-cZmeqOJyEbl1XJuLK4z8zv2s

Environmental Justice

Detail	Source
Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.	https://www.epa.gov/environmentaljustice/learn-about-environmental-justice

<p>Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies.</p> <p>Meaningful involvement means: People have an opportunity to participate in decisions about activities that may affect their environment and/or health; The public's contribution can influence the regulatory agency's decision; Community concerns will be considered in the decision making process; and Decision makers will seek out and facilitate the involvement of those potentially affected.</p>	
	<u>Na Pua Makani Project and Community Opposition Timeline</u> (Jessica's Timeline + Anna's Timeline in chart form)
	http://oeqc2.doh.hawaii.gov/Miscellaneous_Docs/2008-Hawaii-Environmental-Justice-Report.pdf
	http://blog.hawaii.edu/aplpj/files/2011/11/APLPJ_1.1.1_sapolu.pdf

Cultural Impacts

Claim	Detail	Source
The 'opeape'a are sacred to the Hawaiian people and many other Polynesian peoples.	In the Hawaiian creation chant, Kumulipo, the 'ōpe'ape'a, or Hawaiian Hoary Bat, is a kupuna, elder or ancestor, to all Hawaiians. It is a kinolau, or physical embodiment, of Kanaloa, one of the principal deities of Hawaiians, Sāmoans, Tongans, Tahitians, Māori, and others from Moananuiākea (Ka'ili, 2019).	http://www.ulukau.org/elib/cgi-bin/library?e=d-0beckwit2-000Sec--11haw-50-20-frameset-book--1-010escapewin&a=d&d=D0&toc=0 http://www.kauainenehpc.com/uploads/8/1/8/0/81802884/kumulipo-text.pdf Kumulipo Lines: 589, 590, 591, 592 Ka'ili, 2019 Kawena Johnson, 2000 Nakanelua Kumukahi.org Collocott, 1921

		Kaeppler, 2002 Wendt, 1996 Beckwith, 1951 Lili'u'okalani, 1897 K.E. James
The endangered birds threatened by NPM wind project are culturally important.	Aumakua - Ancestral Guardians Makua - Parental / Caretaker Birds Kia'i - Guardian / Protector Birds 'a'o (shearwater) - Makua - KL #299 ae'o (stilt) - indigenous 'alae ke'oke'o (coot) - Makua 'alae 'ula (moorhen) - Aumakua & Makua - KL #303 koloa (duck) - indigenous nene (goose) - Aumakua & Kia'i - KL #349 Pueo - Aumakua & Kia'i - KL #361 'ope'ape'a - kinolau - KL #589, 590, 591, 592	http://www.ulukau.org/clib/cgi-bin/library?e=d-0beckwit2-000Sec--11haw-50-20-frameset-book--1-010escapewin&a=d&d=D0&toc=0 http://www.kauainenehpc.com/uploads/8/1/8/0/81802884/kumulipo-text.pdf

Wildlife Conservation

Claim	Detail	Source
The Ope'ape'a, the Hawaiian hoary bat is the State of Hawai'i's official land mammal.	Senate Bill 1183 designated the Ope'ape'a, the Hawaiian hoary bat (<i>Lasiurus cinereus semotus</i>) as the state land mammal in 2015.	https://www.capitol.hawaii.gov/Session2015/Testimony/SB1183_TESTIMONY_GVO_02-26-15.PDF
'Oep'ape'a are an essential part of Hawai'i's ecological health playing a vital role as a natural insecticide. Ben Okimoto of the Honolulu Zoo stated in 2015 that "it has been known to feed on termites, mosquitoes, moths, beetles, flies, crickets, and stink bugs."	"Bats are essential to the health of our natural world. The more than 1300 species worldwide help control pest insects and are vital pollinators and seed-dispersers for countless plants. Hawaiian hoary bats are insectivorous, feeding primarily on moths and beetles. The pest-control services of Hawaiian hoary bats to fields and forests across the islands are as natural as they are valuable reducing the need for toxic pesticides that linger in the soil and water."	https://www.capitol.hawaii.gov/Session2015/Testimony/SB1183_TESTIMONY_GVO_02-26-15.PDF (Bat Conservation International, 2015) (Okimoto, 2015)

<p>The state fails to implement the Endangered Species Act 16 U.S.C. §1531 et seq. (1973) to protect endangered species in its approval of incidental take licences for wind power projects.</p>	<p>The Endangered Species Act prohibits and action that causes a "taking" of any listed species of endangered fish or wildlife. As of september 11, 2019 the BLNR has approved the "taking" of 706 Critically endangered opeapea. Wind projects also affects nene and other endangered birds.</p>	<p><u>Endangered Species Act 16 U.S.C. §1531 et seq. (1973)</u></p> <p><u>Auwahi Wind Energy LLC 140</u> <u>Tawhiri Power LLC 26</u> <u>KWP II LLC 38</u> <u>Kawailoa Wind Power LLC 265</u> <u>Na Pua Makani LLC</u> <u>Pakini Nui Wind Farm</u> <u>Kaheawa Wind Power II</u></p>
<p>The Na Pua Makani project will kill indigenous, threatened and/or endangered winged species including the 'ope'ape'a (bat), 'a'o (shearwater), ae'o (stilt), 'alae ke'oke'o (coot), 'alae 'ula (moorhen), koloa (duck), and nene (goose).</p>	<p>The Na Pua Makani Power Partners, LLC (applicant) a subsidiary of Champlin Hawaii Wind Holdings, LLC, is requesting an ITP for a 21-year permit term to authorize take of the threatened Newell's shearwater (<i>Puffinus newelli</i>), and the endangered Hawaiian stilt (<i>Himantopus mexicanus knudseni</i>), Hawaiian coot (<i>Fulica americana alai</i>), Hawaiian moorhen, (<i>Gallinula chloropus sandvicensis</i>), Hawaiian duck (<i>Anas wyvilliana</i>), Hawaiian goose (<i>Branta sandvicensis</i>), and Hawaiian hoary bat (<i>Lasiurus cinereus semotus</i>) that may occur as a result of the construction and operation of the project.</p>	<p>Final Habitat Conservation Plan and Supplemental Final Environmental Impact Statement; Na Pua Makani Wind Energy Project, Oahu, Hawaii https://www.federalregister.gov/documents/2016/11/17/2016-27635/final-habitat-conservation-plan-and-supplemental-final-environmental-impact-statement-na-pua-makani</p>
<p>Two of the 5 measures in the NPMWPs HCP include research, one for bats and one for the shearwaters.</p> <p>Fencing to protect nene.</p>	<p>To offset anticipated take associated with construction and operation of the project over a period of 21 years, the applicant is proposing mitigation measures on Oahu that include: (1) Funding research to support effective management of Newell's shearwaters; (2) fencing and predator control to conserve the Hawaiian goose at James</p>	<p>Final Habitat Conservation Plan and Supplemental Final Environmental Impact Statement; Na Pua Makani Wind Energy Project, Oahu, Hawaii https://www.federalregister.gov/documents/2016/11/17/2016-27635/final-habitat-conservation-plan-and-supplemental-final-environmental-impact-statement-na-pua-makani</p>

<p>Forest restoration in Poamoho for bats (Wahiawa is far away from Kahuku).</p> <p>Fencing at Hamakua (Kailua is far away from Kahuku) for the stilt, coot, moorhen and duck.</p> <p>***All of these measures fail to provide a net recovery benefit for the bats.</p>	<p>Campbell National Wildlife Refuge; (3) a combination of bat research and native forest restoration and management to increase Hawaiian hoary bat habitat; (4) acoustic surveys to document occupancy of the affected area by the Hawaiian hoary bat; and (5) fencing and public outreach at Hamakua Marsh to benefit conservation of the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck.</p>	
<p>The HCP is supposed to result in a “net recovery benefit to the affected species” (DLNR, 2019) but the NPM Project fails to do so according to the Keep the North Shore Country and the BLNR Hearings Officer who agreed with KTNCS in its contested case against the approval of the flawed HCP.</p>	<p>Pursuant to State of Hawai‘i endangered species law, codified in Chapter 195D, Hawai‘i Revised Statutes (HRS), it is unlawful for any person to “take” an endangered or threatened species of aquatic life, wildlife, or land plant. “Take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect endangered or threatened species of aquatic life or wildlife, or to cut, collect, uproot, destroy, injure, or possess endangered or threatened species of aquatic life or land plants, or to attempt to engage in any such conduct (Section 195D-2, HRS).</p> <p>When development projects or land management activities cannot avoid take of endangered or threatened species, the landowner may seek an Incidental Take License (ITL) from the Department for take of threatened or endangered species, if such take is incidental to an otherwise lawful activity. The ITL must be accompanied by a Habitat Conservation Plan (HCP) that meets the requirements enumerated under Chapter 195D, HRS, including incidental take measures for minimization, mitigation, monitoring, and provide for a net recovery benefit to the affected species.</p>	<p>HCP and ITL information -https://dlnr.hawaii.gov/wildlife/hcp/</p> <p>Intermediate Court of Appeals Opening Brief - https://0abf3b47-7510-485f-911b-de813d49bf8c.filesusr.com/ugd/3d4a9f_adaa64562d2f49a8904f57d14af11a61.pdf</p>
<p>More comprehensive studies are needed to determine the actual population size of the ‘ope‘ape‘a.</p>	<p>The <u>state’s white paper on conservation efforts was only released in 2013</u> and the <u>State of Hawaii</u></p>	<p>https://dlnr.hawaii.gov/wildlife/files/2013/09/Bat-White-Paper-Guidance_FINAL-sf.pdf</p>

How can HCP's claim to mitigate bat takes when there is no reliable baseline data to determine if a net recovery benefit?	<u>Endangered Species Committee only submitted its conservation proposal in 2016.</u>	https://dlnr.hawaii.gov/wildlife/files/2016/06/1-Bat-movement-behavior-and-diet_to-post.pdf
Inadequate Habitat Conservation Plan Challenged to Intermediate Court of Appeals	Keep the North Shore Country is asking the Intermediate Court of Appeals to reverse a decision accepting the Habitat Conservation Plan (HCP) for the Na Pua Makani wind project as it does not address federal laws requiring that populations of endangered species be left in better conditions than they were before.	https://www.keepthenorthshorecountry.org/
The project is expected to kill many other threatened, native or endangered species including the threatened Newell's shearwater, and the endangered Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, Hawaiian duck, Hawaiian goose	“Na Pua Makani Power Partners applied to the Service for an ITP under ESA section 10(a)(1)(B). The ITP is for a 21-year permit term and authorizes take of the threatened Newell's shearwater (<i>Puffinus newelli</i>), and the endangered Hawaiian stilt (<i>Himantopus mexicanus knudseni</i>), Hawaiian coot (<i>Fulica americana alai</i>), Hawaiian moorhen (<i>Gallinula chloropus sandvicensis</i>), Hawaiian duck (<i>Anas wyvilliana</i>), Hawaiian goose (<i>Branta sandvicensis</i>), and the Hawaiian hoary bat (<i>Lasiurus cinereus semotus</i>) (collectively these species are hereafter referred to as the “covered species”) that may occur as a result of the construction and operation of the project.”	https://www.federalregister.gov/documents/2018/10/03/2018-21457/record-of-decision-for-the-final-environmental-impact-statement-for-the-na-pua-makani-wind-energy
		https://www.thegwpf.com/new-study-german-wind-turbines-kill-1200-tons-of-insects-per-year/
		https://stopthesethings.com/2019/05/23/busted-bugs-german-wind-turbines-demolishing-1200-tonnes-of-insects-each-year/
	Karen Nelson, German Association to Protect People and Animals from Industrial Noise - “There could definitely be a problem with bees. When they	https://www.aph.gov.au/DocumentStore.ashx?id=814fc7d0-8eed-4c1c-8430-db94d76a0fcc&subId=353019

	come back to the hive after finding a food source they communicate through dancing combined with infrasound to bees in the hive where the food is to be found. Big wind turbines produce a lot of infrasound at the same frequencies that the bees use. That infrasound could definitely interfere with bee communication.”	
<p>Karen Nelson, German Association to Protect People and Animals from Industrial Noise - “A neglected aspect concerning the decision to erect wind turbines near where endangered Hawaiian hoary bats (Ōpea‘ape‘a) live, is that each wind turbine destroys 50 kilos of insects per wind turbine per year*. Your hoary bats depend entirely on insects for food. The bats where I live in Germany are also entirely dependent on insect food. In Germany wind turbine constructors are required by law to provide compensatory measures to mitigate the effects of wind turbine operation on the ecosystem. Part of the compensation is providing bird and bat nesting boxes in the area to compensate for chopped down nesting opportunities. At best this is a cosmetic measure. At worst it lures bats and birds to a place where they will eventually starve because their insect food supply no longer exists.</p> <p>></p> <p>> I have lived in a house in the middle of the woods on an island in a pond since 1980 (Germany). In all the years up until 2018 I could hear the socializing sounds of bats in the attic - all year round. Here the young were raised. In 2014 four 200 m high wind turbines were erected 400, 500, 600 and 800 m away from the house. To protect bats in the area, the wind turbines are required by law to be stopped when wind speed and temperature are at certain levels, indicating that bats could be out feeding. Despite this "protection" the bats were gone in 2018 and they have not returned in 2019. Simultaneously, the previously enormous number of insects flying over the pond was immensely reduced. In this pesticide and herbicide free wooded area the decades long general decrease in insect number had not been noticeable. Considering that the wind turbines were stopped when the bats flew, it is unlikely that the bats were directly destroyed by flying into the wind turbines. More likely, the four years of insect destruction, (close to a ton of insects!) cost the bats their food supply. At the same time the number of nesting wagtail pairs (small insect eating bird) was reduced from five or six per year to only one.”</p> <p>“If the wind industry says insect killing is negligible ask why there is a whole developing industry to periodically clean wind turbine blades. The reason is that the build up of insect remains disturbs the aerodynamics so much that there can be a decrease in power output of up to 50%.”</p>		
	Findings on decarbonization plans in the U.S. -- also includes issues of wildlife harm.	https://media4.manhattan-institute.org/sites/default/files/R-RB-1016.pdf

Industrial Turbine Safety Threats

Detail	Source
Fires - Three fires at Kahuku Wind farm from april and may 2011 and shut down the facility in 2012 till feb 2014	https://www.windpowermonthly.com/article/1284038/analysis-first-wind-project-avoids-storage-30m-fire
Blade Throw - The blades, hub and nacelle of one of eight Auwahi Wind turbines in the Kanaio area separated from the tower and fell to the ground on October 4th 2016	https://stopthesethings.com/2016/11/29/mortal-danger-wind-turbines-throw-blades-disintegrate-collapse-with-alarming-regularity/?fbclid=IwAR2quiTaJ-G6_NyraszAoOO18TikGwm3JoAKF1nTo3gafB11yIxAtXsNeXc https://patch.com/massachusetts/falmouth/vestas-wind-turbine-blade-throw-safety-zone-1640-feet
Lightning wind turbines are getting so tall that they frequently generate “up lightning.” This type originates from the turbine's own electric field and leaps from the tip of a blade to meet a downward bolt.	https://www.scientificamerican.com/article/lightning-strikes-are-a-big-problem-for-wind-turbines/

Property Values

Detail	Source
578 homes in kahuku. Median value is 516,300. 12% loss would be 35,810,568 in loss for kahuku. 40% would be 119,368,560	2017 american community survey, Michael McCann, 2010, London School of Economics
<p>According to the London School of Economics, wind farms decrease property value by up to 12 per cent if the home is within a two km radius and can even affect a property's value up to 14 km away from the home. ... Clearly, wind turbines do affect landowners' property values.</p> <p>Real estate and appraisal businesses maintain that wind power does affect property values. Michael McCann of McCann Appraisal, LLC out of Chicago said that “residential property values are adversely and measurably impacted by close-proximity of industrial-scale wind energy turbine projects to the residential properties,” if they are up to 3.2 km away. They decrease a property’s value by 35 to 40 per cent.</p>	https://www.wind-watch.org/news/2018/04/04/wind-turbines-affect-property-values/ April 4, 018

<p>In fact, the Ontario Superior Court ruled in 2013 that landowners living near large wind farms suffer from lower property values. That court said it decreased property values by 22 to 55 per cent.</p> <p>Clearly, wind turbines do affect landowners' property values. Paintearth County proposes a 500-metre setback from homes. The landowners want a 1.5 km setback. Given that studies prove property values decrease when wind turbines are two km from homes, is a 1.5 km setback even enough?</p>	
<p>Appraisals expert Ben Lansink of London has told the Huron East Administrative Committee that rural residential property values fall when either turbines are erected, or transmission lines are cut through the landscape. He was addressing the committee, which determines the agendas for regular meetings of Huron East Council on Tuesday.</p> <p>Lansink has done two studies in Ontario townships where wind farms have located. He says adjacent residential property values fall between 25 and almost 60 per cent.</p>	<p>November 29, 2012 www.bayshorebroadcasting.ca</p>
<p>"It clearly depends on your proximity to the turbines. So one thing I can point to in Clinton and Franklin counties, if you go from having turbine nowhere nearby to having a turbine within about a mile of your home, you are looking at 12 or 13 percent decline in property values. That number's going to depend on exactly how close you are to the turbines.</p>	<p>https://www.wind-watch.org/news/2011/07/26/study-shows-wind-turbines-have-mixed-affect-on-property-values/</p>
<p>Stigma & Decreased Demand</p> <p>The anticipation of adverse effects from wind farms has been noted in some studies to have more impact on value, than the effects of the wind farms themselves.</p> <p>While all of the above may not deter every buyer or homeowner, the stigma of such issues alone can diminish the pool of potential buyers, thus causing some negative impact on the price of the property.</p> <p>Among the studies we reviewed, the highest diminution we saw was 40% (nearly half of what the president suggests), and that was in circumstances where the wind turbine was located directly on the property. While that loss percentage was on the high end, most studies show that the losses in property value from wind farms in the United States is somewhere between 0% and 35%.</p>	<p>Apr 5, 2019 https://www.greenfieldadvisors.com/2019/04/do-windmills-affect-property-value/</p>
<p>So what do most Realtors think of a property that once had an attractive view but now looks at wind turbines? According to our research, an overwhelming majority of Realtors say that wind turbines negatively impact property value. They estimate the range of impact to be from a 10% price reduction to being completely unsellable.</p>	<p>February 2011 https://forensic-appraisal.com/wind-turbines</p>

	https://o.b5z.net/i/u/6016107/f/Wind_Power_Property_Value_Presentation_by_Kurt_C_Kielisch_Feb_11_.pdf
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